

What is Claimed:

- 1        1. A bonding tool for bonding a wire to a substrate, the bonding tool  
2 having a body and a working tip coupled to one end of the body, and comprising:  
3                an orifice extending along a longitudinal axis of the body and the working  
4 tip; and  
5                a coating disposed over at least a portion of a surface of the orifice.
- 1        2. A capillary bonding tool according to claim 1, wherein the coating  
2 extends along an entire length of the orifice.
- 1        3. A capillary bonding tool according to claim 2, wherein the coating  
2 is applied to at least a portion of an exterior surface of the working tip.
- 1        4. A capillary bonding tool according to claim 1, wherein the coating  
2 is disposed over at least a portion of an exterior surface of the working tip.
- 1        5. A capillary bonding tool according to claim 1, wherein the coating  
2 is disposed over an exterior surface of the working tip and the body.
- 1        6. A capillary bonding tool according to claim 1, wherein the coating  
2 is a polymer.
- 1        7. A capillary bonding tool according to claim 1, wherein the coating  
2 is at least one of i) a polymer, ii) an Alumina, iii)  $Si_3N_4$  iv) silica v) a combination of  
3 12% silica and 88% Alumina, and vi) Diamond like Silica (DLC).
- 1        8. A capillary bonding tool according to claim 1, wherein the coating  
2 is a polymer disposed along an interior surface of the orifice and one of i) an Alumina,  
3 ii)  $Si_3N_4$ , iii) silica, iv) a combination of 12% silica and 88% Alumina, and v) Diamond  
4 like Silica (DLC) disposed along an exterior portion of the orifice.
- 1        9. A capillary bonding tool according to claim 1, wherein the coating  
2 has a substantially uniform thickness.
- 1        10. A capillary bonding tool according to claim 1, wherein the coating  
2 has a substantially uniform thickness of up to about 2.0 microns.
- 1        11. A capillary bonding tool according to claim 1, wherein the coating  
2 has a substantially uniform thickness of about 0.1 microns.

1                   12. A capillary bonding tool according to claim 1, wherein the body of  
2 the bonding tool has a substantially cylindrical shape.

1                   13. A capillary bonding tool according to claim 1, wherein the coating  
2 is one of polyolefine and parylene.

1                   14. A capillary bonding tool according to claim 1, wherein the coating  
2 is formed by vapor phase deposition.

1                   15. A capillary bonding tool according to claim 1, wherein the coating  
2 is formed by one of chemical vapor deposition and physical vapor deposition.

1                   16. A capillary bonding tool according to claim 1, wherein the coating  
2 is formed by immersing the bonding tool in a coating material.

1                   17. A method of manufacturing a capillary bonding tool for bonding a  
2 fine wire to a substrate, the method comprising the steps of:

3                   forming a cylindrical body;

4                   forming a taper at a first end of the body;

5                   forming an orifice extending along a longitudinal axis of the body; and

6                   coating at least a portion of the orifice with a polymer.

1                   18. The method according to claim 17, wherein the coating step forms  
2 a substantially uniform continuous coating having a thickness of up to about 2.0  
3 microns.

1                   19. The method according to claim 17, wherein the coating step forms  
2 a substantially uniform continuous coating having a thickness of at least about 0.1  
3 micron.

1                   20. The method according to claim 17, wherein the coating step  
2 comprises the steps of:

3                   forming a precursor monomer at a first temperature and a first pressure;

4                   and

5                   forming the coating from the precursor monomer at a second temperature

6                   and pressure.

1                   21. The method according to claim 20, wherein

2                   the first temperature is about 690°C,  
3                   the first pressure is about 0.5 torr,  
4                   the second temperature is about 25°C, and  
5                   the second pressure is about 0.1 torr.

1               22. The method according to claim 20, wherein the precursor monomer  
2               is formed from a di-Para-Xylyene dimer vaporized at about 150°C and about 1.0 torr  
3               followed by a pyrolysis at about 690°C and about 0.5 torr.

1               23. The method according to claim 17, wherein the capillary is formed  
2               by i) one of direct ceramic dye pressing and ii) injection molding, and machined to a  
3               final shape by one of i) grinding and ii) Electro discharge machining.

1               24. A bonding tool for bonding a wire to a substrate, comprising:  
2               a body portion;  
3               a working tip coupled to one end of the body;  
4               an orifice extending along a longitudinal axis of the body and the working  
5               tip;  
6               a first coating disposed over at least a portion of a surface of the orifice;  
7               and  
8               a second coating disposed over at least a portion of an exterior surface of  
9               the body.

1               25. A capillary bonding tool according to claim 24, wherein the first  
2               coating is a polymer and the second coating is other than a polymer.

1               26. A capillary bonding tool according to claim 25, wherein the second  
2               coating is one of an alumina and  $Si_3N_4$ .

1               27. A method of manufacturing a capillary bonding tool for bonding a  
2               fine wire to a substrate, the method comprising the steps of:

3               forming an orifice extending along a longitudinal axis of the bonding tool;  
4               coating at least a portion of the orifice with a polymer; and

5 coating at least a portion of an exterior surface of the bonding tool with a  
6 non-polymer coating.